UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

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OFFICE OF
PREVENTION, PESTICIDES AND
TOXIC SUBSTANCES

MEMORANDUM

SUBJECT: Screen of Benomyl Incidents

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EXECUTIVE SUMMARY

The conclusions reached here are based exclusively on EFED screening efforts.

A total of 117 incidents were screened to determine whether off-target damage was reported and to determine if benomyl DF or something in benomyl DF may have caused the crop damage.

In only one incident was off-site damage reported. It was not possible to determine, with certainty, the cause of this off-target damage. This off-target damage was not considered to represent a significant ecological impact.

It is likely that something in benomyl DF caused at least some of the incidents of crop damage reported to EPA. In cases where a specific contaminant was identified, it was atrazine.

A few of the incidents screened seemed to have been caused by things other than benomyl DF or a contaminant of benomyl DF.

DISCUSSION

A total of 117 incidents were screened out of the 450 provided. The EEB screened all incidents provided for the following crops:

beans
blackberries
blueberries
eggplant
grapes
peanuts
pumpkins
raspberries
squash
yams
mushrooms
watermelons

This type of crop by crop screen provided a multi-state view. This approach also allowed us to evaluate information from different growers to determine if similar types of injury were observed on similar crops in different locations.

Furthermore, special attention was given to screening the incidents that were accompanied by a greater amount of documentation. So most of the incidents which were contained in the larger (brown) folders were screened to see if they provided better information.

These incidents were screened to determine if any off-target phytotoxicity had been reported. These incidents were also screened to determine if there was evidence linking the damage of the target crop to the active ingredient (benlate), the formulation (benomyl DF) or a contaminant in benomyl DF. The specific information sought was laboratory analysis, careful reporting of the timing of the onset of damage in relation to the applications of benomyl DF, and other specific evidence that would link the damage to the application of benomyl DF.

OFF-TARGET DAMAGE TO NATIVE VEGETATION

In only one incident screened was off-target damage reported. This was incident number 761. In that incident, damage to hickory, scrub oak and weeds was reported. The information provided did not support a conclusion that this damage was caused by benomyl DF or a contaminant. The certainty associated with this incident was described as possible[1] in that benomyl DF or a contaminant contained therein may or may not have caused the damage. It could not be ruled out, nor was there evidence linking it to the damage. The off-site damage reported does not represent a significant ecological effect having long-term implications to the local ecosystem.

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[1] See attached description of the certainty rankings

DAMAGE TO CROPS AND THE LINK TO BENOMYL DF

The large number of plant damage incidents circumstantially related to benomyl DF treatment, and the similarity of adverse effects reported by growers of the same crops in different growing areas suggests either the formulation, the active ingredient, a metabolite of, or a contaminant (herbicide) in benomyl DF may have been the cause. However, based on a screen of the data provided in 117 of the incidents provided to EPA it is concluded that in almost all cases (97), the scientific evidence linking benomyl DF to the actual damage was weak or non-existent. In most cases, the only link was that benomyl was used during the same season when the damage occurred.

There are however, some notable exceptions. In some (20) cases, there is evidence linking the use of benomyl DF with the damage that was reported. The following kinds of evidence were considered persuasive:

1- When the "timing" of damage and recovery of the plants is linked closely with the use and discontinued use of benomyl, this is considered pertinent and increases the certainty linking use of benomyl to the damage reported.

2- When chemical analysis identified a contaminant in the benomyl DF, or in the plants that were damaged, there is a higher certainty that the damage was caused by that contaminant. In 11 of the 20 cases screened where a certainty was "likely" or "probable"[1], atrazine was positively identified as being present at the time of the damage. In addition, the registrant has admitted that some batches of benomyl DF were contaminated with atrazine.

In none of the cases (except where damage was attributed to causes other than benomyl DF treatment) was there evidence to rule out, with high certainty, the possibility that the benomyl was contaminated with other herbicides besides, or in addition to, atrazine, or that a metabolite (or metabolites) of benomyl caused, or synergistically augmented, the damage.

Other possible causes of the damage, in cases where the relative certainty that damage was related to benomyl DF treatment, was unlikely or unrelated, include:

1- fertilizer contamination (by unknown chemicals).
2- soil nutrient deficiency
3- lack of efficacy leading to damage by disease which would be associated, loosely, with benomyl DF treatments.
4- Herbicide of unknown source. (In incident 1817, paraquat and oryzalin were detected in leaves of damaged plant tissue.)
5- High levels of disease; nematodes were documented in some fields.

6- Routine use of herbicides, by growers/neighbors, that may have drifted onto, or been unintentionally applied directly to, the crop.

QUALITY OF THE INCIDENT REPORTS

The incidents accompanied with greater amounts of documentation in the larger (brown) folders did not necessarily contain better information.

The reason why it is not possible to attribute a greater scientific certainty to the causative agent in these incidents is because of a lack of supporting evidence in most cases. According to the incidents screened, it was apparent that a scientific approach to investigation was not usually employed. The following are examples of what is lacking. These are not, in anyway, provided to disparage the reported incidents, nor to lessen the significance of the damage done. It is merely provided as an explanation of why, scientifically, greater certainty cannot be applied to these incidents as they are reported to EPA.

1- Incomplete reporting of information
>photo's missing
>DuPont correspondence to grower missing
>court proceedings/interrogations missing
>Florida State records missing
>In many cases, where laboratory analysis was alluded to, the laboratory reports are missing.
>Correspondence and analysis from independent plant investigators and experts not provided.

2- Apparently analysis for Sulfonyl Urea's (SU's) was not done. Note that given the levels at which SU's may be toxic to plants, it may not have provided any more information. Levels of detection may not be low enough to detect (SU's), or other low dose herbicides, at concentrations that are harmful to plants. The SU's may have been causative agent and not atrazine in at least some of the incidents, given the relatively low levels of atrazine detected and the high level of plant injury reported.

3- There was virtually no description of micro-climate (temperature, humidity, soil conditions, micro-nutrients, fertilizer practices) conditions before, during and after onset of plant phytotoxicity. This will preclude relating the damage reported in these incidents to research attempting to show that under very specific conditions, benlate or benomyl DF may actually cause phytotoxic effects at typical application rates.

OTHER INFORMATION

There is other information which, if obtained, may be useful in identifying the cause of the incidents.

DuPont should be asked to provide the documentation they have on the atrazine contamination of benomyl DF. This includes such things as what lots were contaminated and where those lots were shipped. It would also include the concentrations detected and how many containers were sampled for analysis.

DuPont should be asked if plant bioassay's were conducted to determine how much (concentration, rate, dose) of the contaminant it would take to injure the various crops for which damage was reported.

DuPont should provide information on the various injury symptoms known to be caused by Atrazine for the various crops that were damaged.

REGULATORY SUMMARY

The ecological damage reported in the incidents screened is insufficient to recommend any regulatory action. It is reasonable to assume that there may be some correlation with the use of benomyl DF and the crop damage that was reported. The incidents, however, provide little scientific evidence to support a recommendation to regulate benomyl DF based on adverse ecological effects or target area phytotoxicity.

Again, it is suggested that other expertise beyond that in EFED be employed to analyze benomyl research and screen the incidents. The USDA, Florida State Department of Agriculture and Florida University officials and researchers may wish to further investigate the incidents that we identified as having high certainty levels. These organizations could lend greater confidence to conclusions reached on the issue of target area phyto-toxicity.

ATTACHMENT

Certainty Rankings:

The higher the certainty rating, the greater the support for attributing the damage to applications of benomyl DF. The following certainty rating categories were used. These are the same certainty ratings applied to all fish, wildlife and plant incidents screened by EEB. Note that the certainty rating, for these incidents, indicates a relative confidence that a contaminant in benomyl DF, the benomyl DF formulation, a metabolite of the active ingredient (benlate), or benlate itself was that cause of the incident. Where chemical analysis establishes the presence of a causative agent in either the benomyl applied, the soil, or the plant tissue of the damaged crop, the certainty would apply to the specific causative agent (i.e. atrazine in most cases)

The following are the 5 possible certainty ratings.

LIKELY: Highest certainty, strong link between applications and benomyl DF. Some examples include:

- the timing of the damage coincided closely with the applications of benomyl DF,
- that chemical analysis shows presence of contaminating herbicide that is known to be able to cause the damage observed.

PROBABLE: Next Highest, some link between damage and applications of benomyl DF.

POSSIBLE: Little or no evidence to link damage to benomyl DF applications, but evidence does not rule out benomyl DF, metabolites or contaminants as being the causative agent.

UNLIKELY: Evidence provided strongly suggests some other factor caused the damage.

UNRELATED: Evidence available positively linking damage to other causative agents besides benomyl DF applications.